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<p>(21) International Application Number: <b>PCT/SE90/00814</b> (22) International Filing Date: <b>10 December 1990 (10.12.90)</b> (30) Priority data: <b>480728 16 February 1990 (16.02.90) US</b> (71) Applicant: <b>TRETORN AB [SE/SE]; P.O. Box 931, S-251 09 Helsingborg (SE).</b> (72) Inventors: <b>BOGATY, Robert ; 108 Aberdeen Drive, Scituate, MA 02066 (US). CHAPMAN, Steven ; 150 Rumford Avenue, Mansfield, MA 02048 (US). DOYLE, David ; 36 Sunnyside Drive, Norwood, MA 02062 (US). MOCHEN, Richard ; 12 Oak Road, Milton, MA 01860 (US).</b></p>		<p>(74) Agents: <b>HOLMQVIST, Lars, J., H. et al.; Lars Holmqvist Patentbyrå AB, P.O. Box 4289, S-203 14 Malmö 4 (SE).</b> (81) Designated States: <b>AT (European patent), BE (European patent), CH (European patent), DE (European patent), DK (European patent), ES (European patent), FR (European patent), GB (European patent), GR (European patent), IT (European patent), JP, KR, LU (European patent), NL (European patent), SE (European patent).</b>  <b>Published</b> <i>With international search report.</i> <i>With amended claims.</i></p>
<p>(54) Title: <b>STABLE SHOE SYSTEMS</b></p> <div data-bbox="574 1310 1117 1612" data-label="Image"> </div> <p>(57) Abstract</p> <p>Athletic shoes, including mid-soles (42, 60, 81, 90, 97) are disclosed, the mid-soles include independent and selectively shaped cells in cushioning units (45, 50, 70, 75, 80), said cells containing unpressurized air. The cells not only act to stabilize the foot, but also to provide cushioning to protect the runner.</p>		

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## STABLE SHOE SYSTEMS

BACKGROUND OF THE INVENTION

5 This invention is directed to shoes and more particularly to shoes for runners who over pronate, over supinate or those who are heel strikers as well as those runners with substantially no biomechanical problems, i.e. neutral gait runners, but who want additional shock dispersion and flexibility. In order to accomplish the above, cushion (pads) 10 containing specially configured cells with memory, and which contain unpressurized air, are preferably suspended in the mid-sole of preferably a sliplasted shoe.

Shoe patents in this general area of technology include 15 United States Patent No. 4,223,455, United States Patent No. 4,878,300 and United States Patent No. 4,854,057.

SUMMARY OF THE INVENTION

20 The invention is directed to shoes, which provide to the user, particularly a runner, cushioning and in the case of certain runners having certain biomechanical problems, the present invention provides correction as well as cushioning and stability depending on how the cushioning pad of this invention is used in the shoe. The cushions of this invention are of 25 plastic material and are constructed with individual cells, the walls of which have memory, so that the cell walls return to substantially their original shape after compression.

The cells each contain unpressurized air at ambient temperature, so that the cells remain intact, even if punctured. Preferably the cells used in the rear portion of the shoes are higher around the outer periphery for stability and combine with the lower in height inwardly positioned cells to form an anatomical heel cradle. In one embodiment, the cushions (pads) incorporate a shock dispersing plate of the type described in United States Patent No. 4,878,300, to provide a firmer effect and even greater stability while retaining cushioning.

10

BRIEF DESCRIPTION OF THE DRAWINGS

Figure 1 is a side elevation of an athletic shoe made in accordance with this invention;

Figure 2 is a portion of the bottom of the shoe;

15

Figure 3 is a top view of the two-part mid-sole of the shoe of this invention;

Figure 4 is a top view of one of the parts of the mid-sole containing a heel cushioning pad according to the invention;

20

Figure 5 is a bottom view of a portion of the mid-sole of Figure 4;

Figure 6 is a sectional view taken along line 6-6 in Figure 4;

Figure 7 is a top view of the heel cushion of the invention;

25

Figure 8 is a top view of a flexible plate, which may be used with the heel cushion of the invention;

Figure 9 is a sectional view similar to Figure 6, in which the plate of Figure 8 is positioned between the upper and bottom portions of the cushioning pad to provide a firmer effect and greater stability;

30

Figures 10-A and 10-B are views similar to Figure 9, in which individual sections of the pad are provided with plastic sheets, so they may be incorporated in the shoe mid-sole as separate units;

35

Figure 11 is a top view of another mid-sole form for use in the shoes of this invention;

Figure 12 is a bottom view of the mid-sole of Figure 11;

Figure 13 illustrates the top view of a rear foot portion of the mid-sole;

Figure 14 illustrates the bottom view of the rear foot portion of the mid-sole;

5        Figure 15 is a sectional view taken along line 15-15 in Figure 11 without the cushioning units in place;

Figure 16 is a sectional view taken along line 16-16 in Figure 13;

10       Figure 17 is a top view of the rear foot cushion shown in Figure 16 without the encapsulating shell;

Figure 17-B is a sectional view of the pad similar to Figure 16, in which a flexible shock dispersing plate as shown in a top view (Figure 17-A), is positioned between the top and bottom portions of the cushioning pad parts to form a cushioning unit;

Figures 18-A and 18-B are views similar to Figure 17-B, in which the top and bottom portions of the cushions are sealed with plastic sheets;

20       Figure 19 is a view similar to Figure 11, in which the position of the heel portion is reversed, so that the cushioning pad is positioned on the arch side of the shoe, instead of along the outer edge of the shoe;

Figure 20 is a front view portion of the shoe showing the front cushioning pad;

25       Figure 21 is a sectional view taken along line 21-21 in Figure 20;

Figures 22 and 23 illustrate sectional views of modified front cushions.

30       DETAILED DESCRIPTION OF THE INVENTION

Reference should now be had to Figures 1 and 2, which show a typical shoe of this invention at 40. The shoe may be of a sliplasted type, i.e. with a sliplasted upper 41, e.g. leather or fabric or other types of construction, as described in United States Patent No. 4,854,057, incorporated herein by reference hereto.

At 42, there is shown the mid-sole of foamed plastic

material, e.g. closed cell foam material such as EVA and at 43, there is an outsole (bottom) of rubber.

In Figure 2, the underside of the shoe is shown, which has an opening defined thereby at 43-1 to permit a portion of the cushion 45, central cell 50-1 to be seen as shown in Figure 6.

Figure 1 illustrates at 46 where the front cushion 46, shown in Figures 20 and 21, would be positioned if incorporated into the shoe.

Figure 3 illustrates that the mid-sole is comprised of two sections, 45 and 48. The mid-sole portion 48, defines a rear opening 48-1, in which the rear heel cushioning unit 45 is positioned in the manner of a jigsaw puzzle. The unit 45 is shown in top and bottom views, Figures 4 and 5, respectively. In Figure 4, the unit 45 has an upper opening 45-1, which is the result of the molding process used to form cushioning, unit 45. The foam outer encapsulating shell of the cushioning unit 45 is shown in section of Figure 6. Figure 5 illustrates the bottom of the unit 45 and shows an opening 45-3, which shows the cushion 50 portion, i.e. central cell 50-1.

The cushion 50 may preferably be vacuum formed from sheet material or alternatively injection molded. The preferred material is a polybutane terephthalate such as Lomod Brand (XB006) polybutane terephthalate (PBT).

The cushion 50 is particularly useful for those runners who are heel strikers. The cushion 50, comprises top 50-A and bottom 50-B sections, which are mirror images of each other or may be different if desired. Each section, 50-A and 50-B comprises outer cells, 50-2 to 50-4, which are taller (of greater height) than the central circular cell, 50-1 and cell 50-5, so as to produce an anatomic heel cradle.

Each of the cells are not interconnected as shown and contain unpressurized air at ambient temperature. The cell walls are of a sufficient thickness, e.g. about 0.7 to 1.5 mm with 1 mm being preferred. The cell walls exhibit memory, i.e. they will return to substantially their original shape after compression. The cell sections, 50-A and 50-B, are each sealed together as shown by, e.g. adhesive or other ways known in the

art to form the individual cells.

In Figure 8, there is shown a shock absorbing plate, 54 of the type described in United States Patent Nos. 4,854,057 and 4,878,300, both of which are incorporated herein by reference  
5 hereto.

The plate is shown positioned in Figure 9 and is bonded, e.g. by adhesive to the cells of cushions sections 50-A and 50-B, so as to form individual upper and lower cells.

The cushion unit of Figure 9 provides additional shock  
10 dispersion flexibility over that shown in Figure 6. It is positioned in the shoe in the same fashion as the structure of Figure 6. The plate, 54 is made from e.g. a composite of polyester resin containing woven or chopped fiberglass, e.g. with 25 % resin. The force dispersing plate is preferably  
15 flexible and substantially non-stretchable.

Figures 10-A and 10-B show further cushion configurations, in which a plastic sheet of the same material as the cells or other plastic is bonded to the cells. The cushion cells may then be used in the shoe as disclosed, in e.g. an upward facing  
20 direction and encapsulated in the mid-sole as disclosed above.

Reference should now be had to Figures 11 to 16 for mid-sole 60, which incorporates a cushion unit 70, for  
antisupination.

The mid-sole 60, is formed of a first section 71, which  
25 defines a rear opening 71-1, in which there is positioned the cushion unit 70 with the cushion unit extending on the outside of the mid-sole to about where the arch would be positioned on the opposite side of the mid-sole. A forward cavity or recess 72 is provided for receiving a cushion 46, as shown in Figures 20  
30 and 21.

Figure 16 shows the cushion 75, having two sections, top 75-A and bottom 75-B, with cells 75-1 to 75-5, of the type described, with respect to Figures 1 to 7.

In addition, forward cells 75-6 and 75-7 are provided to  
35 provide the anti-supination effect. The cushion cells are independent of one another and contain as before, unpressurized air at ambient temperature. The cushion unit 70 is as before, an

outer encapsulating closed cell foam plastic (EVA) shell about the cells as shown in Figure 16 and the mid-sole is used in the shoes as previously described.

5 Figure 17-A shows a force dispersing plate as previously described and used as shown in Figure 17-B between mirror image cells sections bonded thereto to provide additional shock dispersion and flexibility.

10 Figures 18-A and 18-B show modifications of the cushioning cells sealed with a plastic sheet or with the plate 80. These configurations may also be used to provide cushioning, if desired.

15 Figure 19 illustrates a cushioning unit 80, reversed in the mid-sole 81, to provide an anti-pronation effect with the unit and cushion on the inside of the mid-sole and extending to about where the arch begins. A recess 82, is provided for the front cushion if desired.

20 Reference should now be had to Figures 20 and 21, for the forefoot cushion shown at 46. The cushion is not encapsulated, but is positioned in the shoe mid-sole 90, in the recess 90-1 as previously described. The individual cells are shown at 91 and preferably be in a downwardly position in the mid-sole recess and are covered with plastic sheet 94, of the same material as the cells or other plastic material to seal the individual cells 91. The cells contain unpressurized air at ambient temperature.

25 Fig. 22 shows another front cushion configuration having two cellular sections, 96A and 96B, sealed together and positioned in mid-sole 97 in recess 97-1.

30 Fig. 23 shows a forefront cell unit where the cells 98 are sealed at the bottom with a plastic sheet 99, and are positionable in an upward direction.

It should be understood that the cushion cellular member disclosed herein may also be placed in a sock liner if desired in the inside of the shoe upper.



## CLAIMS

1. A shoe including a shoe upper (41), a mid-sole (42, 60, 81, 90, 97) and a shoe bottom (43), said mid-sole having a rear heel plastic cushion (45, 50, 70, 75, 80), said cushion having a  
5 plurality raised compressible portions having memory, one of said portions being a circular portion (50-1, 75-1) positioned in substantially the center of the heel portion of the shoe.

2. The shoe of claim 1, in which the mid-sole comprising first (48, 71) and second (45) sections, said first section  
10 defining an opening (48-1, 71-1) in the rear heel portion thereof, and said second section positioned in said opening, said second section having a cushion (45, 50, 70, 75, 80) therein with a plurality of sealed chambers with walls thereof  
15 having the ability to return to substantially their original shape after compression, said chambers containing unpressurized air, said second section comprising foam plastic material, which encapsulates most of said cushion.

3. The shoe of claim 3, in which the front part of the first section (71) of the mid-sole has a recess (72, 82, 90-1)  
20 and in which a cushion (46) having a plurality of chambers is supported in said recess.

4. The shoe of claim 1, with a shoe cushion comprising upper (50-A, 75-A, 96A) and lower (50-B, 75-B, 96B) plastic sheets forming a plurality of raised portions, the raised  
25 portions in the upper sheet being a mirror image of the lower sheet raised portions, said mirror image raised portions each forming separate cells, which contain unpressurized air, said plastic raised portions being of a plastic material, which will return to its original shape after compression.

5. The shoe of claim 1, with a shoe cushion comprising a  
30 sheet of plastic having raised portions and a flexible plate (54, 79) coupled to the sheet surface to form individual cells, each cell, which contains unpressurized air.

6. The shoe of claim 1, 2 or 4, in which the raised  
35 portions form an anatomical cradle for the heel.

**AMENDED CLAIMS**

[received by the International Bureau  
on 3 June 1991 (03.06.91);

original claims 1 and 4 amended; other claims unchanged (2 pages)]

1. A shoe, comprising a shoe upper (41), a midsole (42, 60, 81, 90, 97) coupled to said shoe upper and a shoe bottom (43) coupled to said midsole, said midsole having a heel portion and a forefoot portion, said heel portion of said midsole having a portion (48-1, 71-1) to receive a shoe cushion member (45, 50, 70, 75, 80), said shoe cushion member positioned in said midsole receiving portion and comprising upper (50-A, 75-A, 96A) and lower (50-B, 75-B, 96B) plastic sheets each forming a plurality of outwardly projecting portions (50-2 - 50-5, 75-2 - 75-5) about the periphery and a central raised portion (50-1, 75-1), said peripheral projecting portions including a rearward projecting portion (50-3, 75-3), the central raised portion projecting outwardly less than the projection of the rearward projecting portion.

2. The shoe of claim 1, in which the midsole comprising first (48, 71) and second sections, said first section defining an opening (48-1, 71-1) in the rear heel portion thereof, and said second section positioned in said opening, said second section having a cushion (45, 50, 70, 75, 80) therein with a plurality of sealed chambers with walls thereof having the ability to return to substantially their original shape after compression, said chambers containing unpressurized air, said second section comprising foam plastic material, which encapsulates most of said cushion.

3. The shoe of claim 2, in which the front part of the first section (71) of the midsole has a recess (72, 82, 90-1) and in which a cushion (46) having a plurality of chambers is supported in said recess.

4. The shoe of claim 1, in which the raised portion in the upper (50-A, 75-A, 96A) plastic sheet being a mirror image of the lower (50-B, 75-B, 96B) plastic sheet raised portions, said mirror image raised portions each forming separate cells, which contain unpressurized air, said plastic raised portions being of a plastic material, which will return to its original shape after compression.

5. The shoe of claim 1, with a shoe cushion comprising a sheet of plastic having raised portions and a flexible plate (54, 79) coupled to the sheet surface to form individual cells, each cell containing unpressurized air.

6. The shoe of claim 1, 2 or 4, in which the raised portions form an anatomical cradle for the heel.

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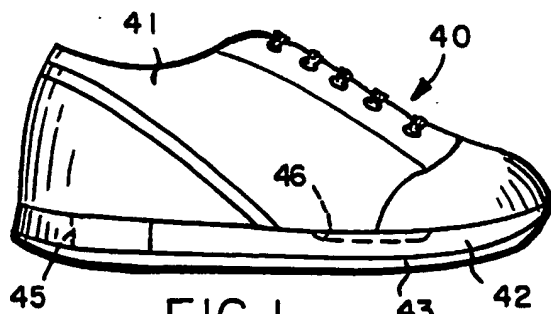


FIG. 1

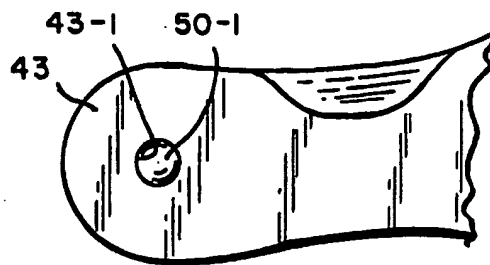


FIG. 2

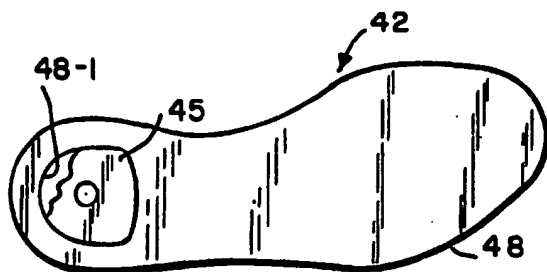


FIG. 3

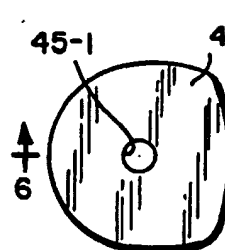


FIG. 4

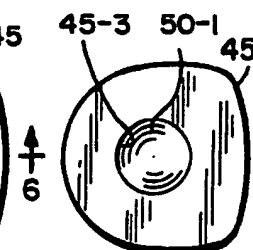


FIG. 5

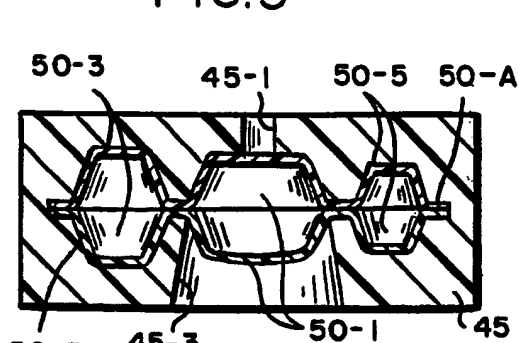


FIG. 6

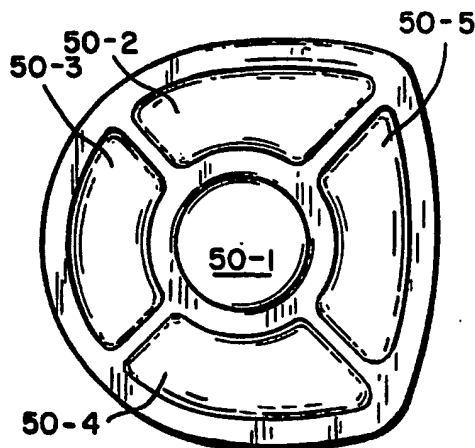


FIG. 7

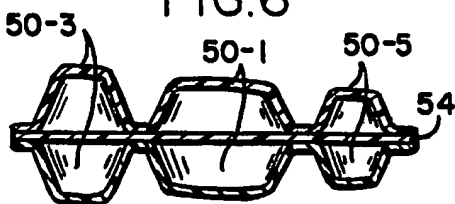


FIG. 9

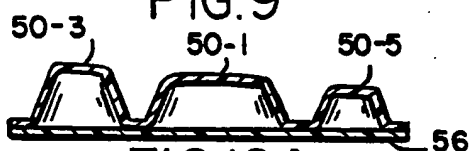


FIG. 10A

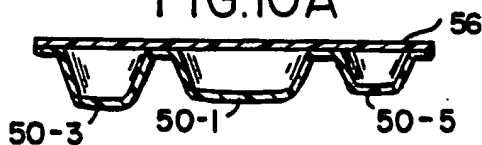


FIG. 10B

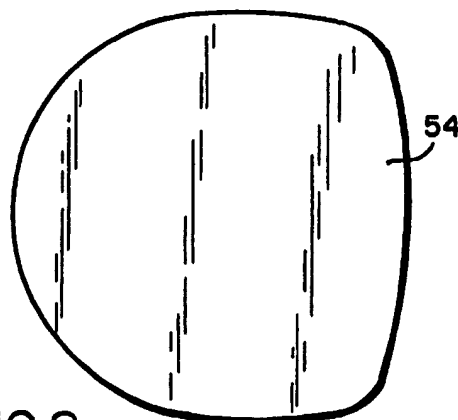
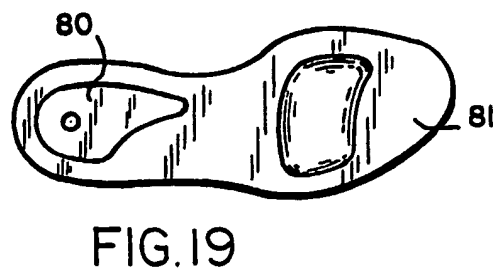
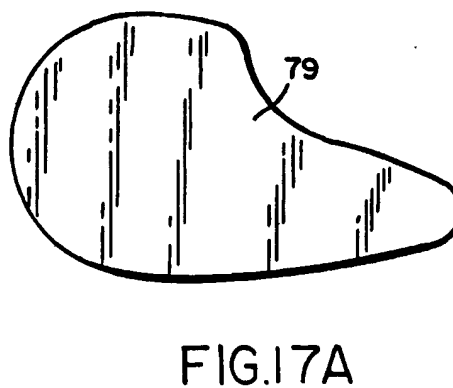
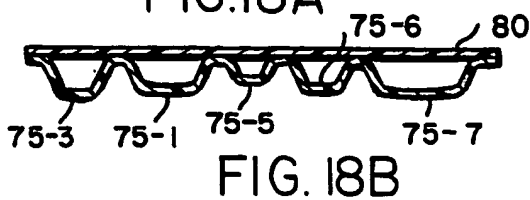
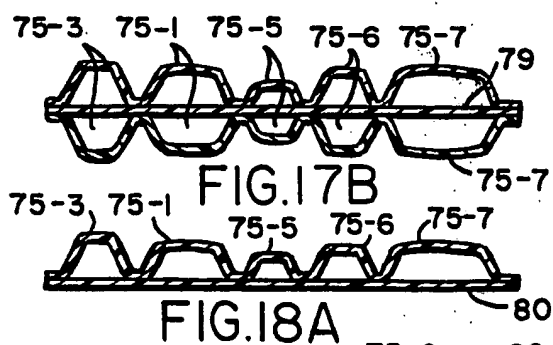
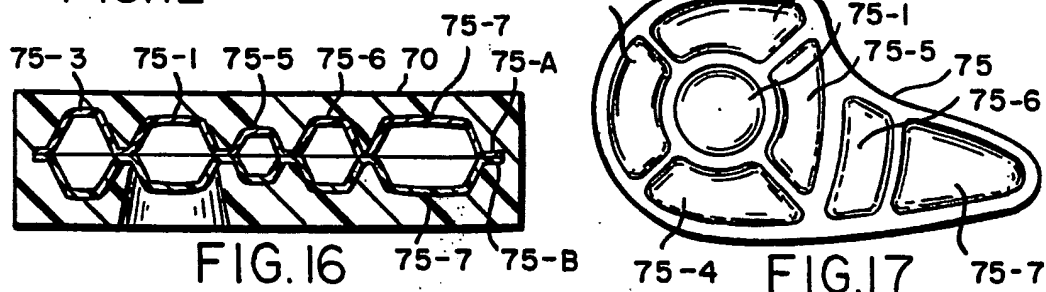
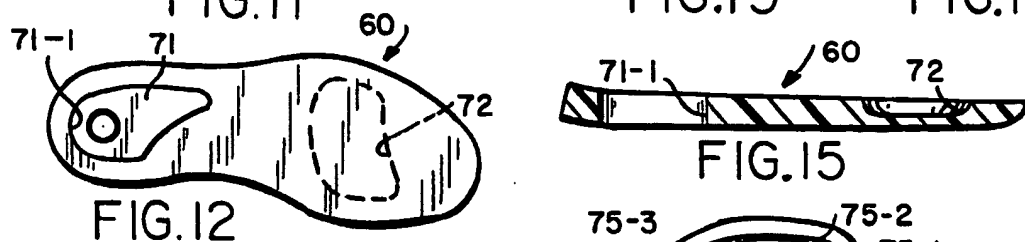
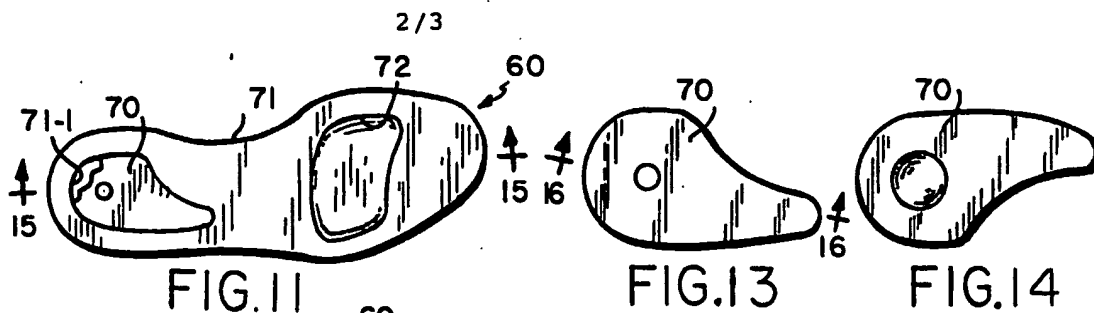


FIG. 8



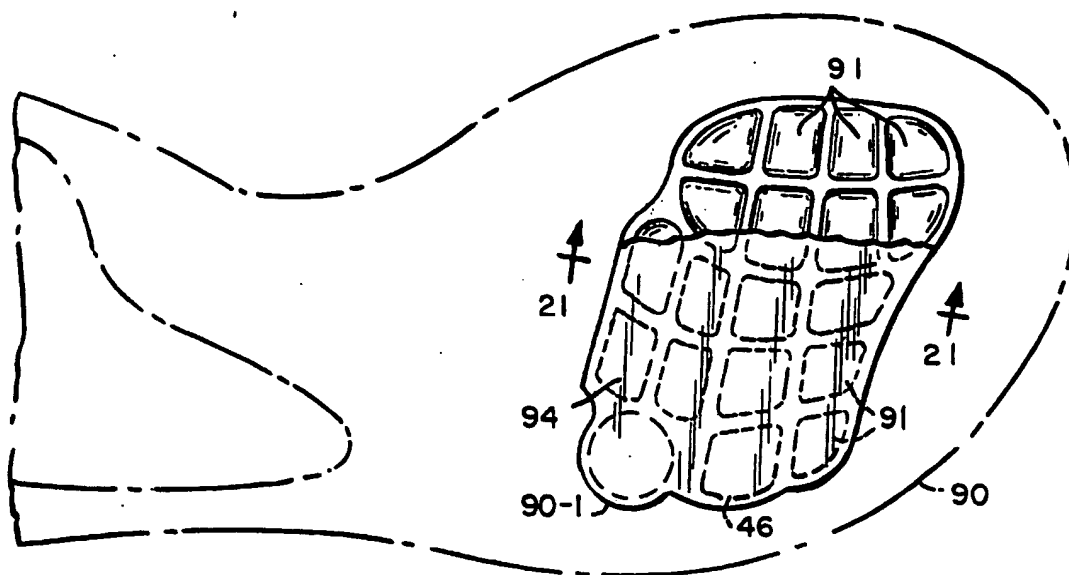


FIG. 20

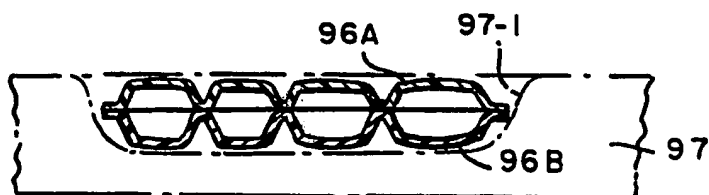


FIG. 22

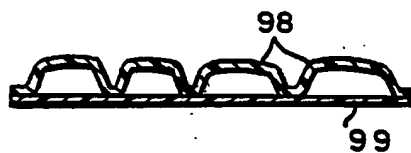


FIG. 23

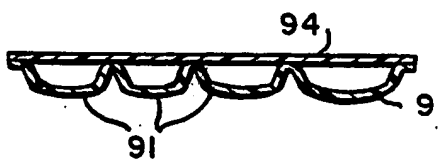


FIG. 21

# INTERNATIONAL SEARCH REPORT

International Application No PCT/SE 90/00814

<b>I. CLASSIFICATION OF SUBJECT MATTER</b> (If several classification symbols apply, indicate all) <sup>6</sup> According to International Patent Classification (IPC) or to both National Classification and IPC <b>IPC5: A 43 B 21/28, A 43 B 13/20</b>		
<b>II. FIELDS SEARCHED</b>		
Minimum Documentation Searched <sup>7</sup>		
Classification System	Classification Symbols	
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SE,DK,FI,NO classes as above		
<b>III. DOCUMENTS CONSIDERED TO BE RELEVANT<sup>9</sup></b>		
Category *	Citation of Document, <sup>11</sup> with indication, where appropriate, of the relevant passages <sup>12</sup>	Relevant to Claim No. <sup>13</sup>
X	DE, A1, 2933393 (FUNCK, HERBERT) 26 February 1981, see figures 4,5 --	1
X	US, A, 1638701 (H.G. NORWOOD) 9 August 1927, see the whole document -- -----	1
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<b>IV. CERTIFICATION</b>		
Date of the Actual Completion of the International Search		Date of Mailing of this International Search Report
9th April 1991		1991 -04-11
International Searching Authority		Signature of Authorized Officer
SWEDISH PATENT OFFICE		Sune Söderling

**ANNEX TO THE INTERNATIONAL SEARCH REPORT  
ON INTERNATIONAL PATENT APPLICATION NO.PCT/SE 90/00814**

This annex lists the patent family members relating to the patent documents cited in the above-mentioned international search report.  
The members are as contained in the Swedish Patent Office EDP file on **91-02-28**  
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Patent document cited in search report	Publication date	Patent family member(s)	Publication date
DE-A1- 2933393	81-02-26	FR-A-B- 2438983 GB-A-B- 2032761	80-05-16 80-05-14
US-A- 1638701	27-08-09	NONE	



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